

What is claimed is:

1. A computer aided surgery navigation system comprising:
  - a. a sensor adapted to sense position of a plurality of indicia
  - 5 attached by a reference frame to an item used in surgery;
  - b. computer functionality adapted to receive information from the sensor about position of the indicia and generate information corresponding to position and location of the item to which the indicia are attached;
  - c. rendering functionality adapted to render an image of the item
  - 10 correctly positioned and oriented in correspondence with the position of its indicia as sensed by the sensor;
  - d. wherein at least one of the indicia is attached to the item using a fault interface which features a failure strength smaller than the failure strength of the reference frame or connection between the reference frame
  - 15 and item, such that force exceeding the failure strength of the fault interface causes the fault interface to fail and the indicium to become dislodged relative to the item; and
  - e. wherein the fault interface features a structure which allows the indicium to be repositioned without the need to reregister the indicium in the
  - 20 system after the interface has failed.
2. A system according to claim 1 in which at least some of the indicia are fiducials.
- 25 3. A system according to claim 2 in which at least some of the fiducials feature reflective surfaces adapted to be sensed by an infrared sensor device.
4. A system according to claim 1 in which at least some of the
- 30 indicia are active devices.

5. A system according to claim 4 in which at least some of the active devices are transponders which emit energy when interrogated.

5 6. A system according to claim 1 in which the fault interface is an asymmetrical structure.

7. A system according to claim 1 in which a plurality of indicia are connected to the item, using a single fault interface.

10

8. A system according to claim 1 in which a plurality of indicia are connected to the item, using a plurality of fault interfaces.

9. A system according to claim 1 in which a plurality of indicia are  
15 connected to the item, using a fault interface corresponding to each indicium.

10. A system according to claim 1 in which the fault interface includes structure adapted to create a friction fit.

20 11. A system according to claim 1 in which the item is a human body part.

12. A system according to claim 1 in which the item is a bone screw.

25 13. A system according to claim 1 in which the item is an implant.

14. A system according to claim 1 in which an additional connection aid is used to attach the indicia to the item.

15. A system according to claim 14 in which the additional connection aid is magnetic attraction.

16. A system according to claim 14, in which the additional  
5 connection aid is adhesive.

17. A system according to claim 14, in which the additional connection aid is hook and pile connectors.

10 18. A system according to claim 1 in which the indicium can be repositioned in only one position and orientation relative to the item after the interface has failed.

15 19. A computer aided surgery navigation system comprising:  
a. an infrared sensor adapted to sense position of a plurality of fiducials attached by a reference frame to an item used in surgery;  
b. computer functionality adapted to receive information from the sensor about position of the fiducials and generate information corresponding to position and location of the item to which the fiducials are attached;  
20 c. rendering functionality adapted to render an image of the item correctly positioned and oriented in correspondence with the position of its fiducials as sensed by the sensor;  
d. wherein at least one of the fiducials is attached to the item using a fault interface which features a failure strength smaller than the failure  
25 strength of the reference frame or connection between the reference frame and item, such that force exceeding the failure strength of the fault interface causes the fault interface to fail and the fiducial to become dislodged relative to the item; and

e. wherein the fault interface features a structure which allows the fiducial to be repositioned without the need to reregister the fiducial in the system after the interface has failed.

5           20.    A system according to claim 19 in which the item is a body part.

          21.    A system according to claim 19 in which the item is a bone screw.

10          22.    A system according to claim 19 in which the item is an implant.

          23.    A system according to claim 19 in which the fault interface is an asymmetrical structure.

15          24.    A system according to claim 19 in which the fault interface includes a key and corresponding slot.

          25.    A system according to claim 19 in which the fault interface includes structure adapted to create a friction fit.

20

          26.    A system according to claim 19 in which an additional connection aid is used to attach the fiducial to the item.

          27.    A system according to claim 26 in which the additional  
25 connection aid is magnetic attraction.

          28.    A system according to claim 26 in which the additional connection aid is adhesive.

29. A system according to claim 26 in which the additional connection aid is hook and pile connectors.

30. A system according to claim 19 in which the fiducial can be repositioned in only one position and orientation relative to the item after the interface has failed.

31. A device for use in a computer aided surgical navigation system, the system comprising a sensor adapted to sense position of a plurality of indicia attached by a reference frame to an item used in surgery; computer functionality adapted to receive information from the sensor about position of the indicia and generate information corresponding to position and location of the item to which the indicia are attached; and rendering functionality adapted to render an image of the item correctly positioned and oriented in correspondence with the position of its indicia as sensed by the sensor; the device comprising a reference frame adapted to be connected to the item, at least one indicium connected to the reference frame, and a fault interface interposed between at least one indicium and the item; wherein the fault interface features a failure strength smaller than the failure strength of the reference frame or connection between the reference frame and item, such that force exceeding the failure strength of the fault interface causes the fault interface to fail and the indicium to become dislodged relative to the item; and wherein the fault interface features a structure which allows the indicium to be repositioned without the need to reregister the indicium in the system after the interface has failed.

32. A process for conducting computer aided surgery, comprising:  
I. providing a computer aided surgery system, comprising:  
a. a sensor adapted to sense position of a plurality of indicia attached by a reference frame to an item used in surgery;

b. computer functionality adapted to receive information from the sensor about position of the indicia and generate information corresponding to position and location of the item to which the indicia are attached;

5 c. rendering functionality adapted to render an image of the item correctly positioned and oriented in correspondence with the position of its indicia as sensed by the sensor;

d. wherein at least one of the indicia is attached to the item using a fault interface which features a failure strength smaller than the failure strength of the reference frame or connection between the reference frame  
10 and item, such that force exceeding the failure strength of the fault interface causes the fault interface to fail and the indicium to become dislodged relative to the item; and

e. wherein the fault interface features a structure which allows the indicium to be repositioned without the need to reregister the indicium in the  
15 system after the interface has failed;

II. registering the indicia into the system;

III. navigating the item during surgery using the image rendered by the rendering functionality;

IV. dislodging at least one indicium in a manner that causes a fault  
20 interface to fail;

V. repositioning the indicium into correct position and orientation relative to the item;

VI. continuing to navigate the item during surgery without the need to reregister the indicium into the system.

25